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(54) Title: A METHOD FOR STEAM DISINFECTION OF THE WASHING TANK OF AN AUTOMATIC DISHWASHER AND AN AUTOMATIC DISHWASHER FOR UTILIZING THE METHOD			
(57) Abstract			
<p>A method for steam disinfection of the washing tank (2) and the hot water tank (4) of a dishwasher, as well as of the pipe connections (10, 26) between these tanks. The novel feature is that the steam required for the disinfection is produced by the heating element (22) located inside the hot water tank (4) upon this tank, by the end of the washing process, being drained to a suitable level (24). The steam is led by pipe connections (26) in the top of the tank to the washing tank (2) for disinfection thereof. Water is not supplied to the hot water tank during the disinfection process, as the top of the inlet pipe to the circulation pump (6) defines a certain minimum water level (24), by which there is enough water left for the production of the steam as required for the disinfection process, whereby dryboiling of the heating element (22) is prevented. Further, a dishwasher and a hot water tank for the use of the method are disclosed.</p>			

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A Method for Steam Disinfection of the Washing Tank of an Automatic Dishwasher and an Automatic Dishwasher for Utilizing the Method.

5 The present invention concerns a method for steam disinfection of the washing tank of an automatic dishwasher, and an automatic dishwasher for utilizing the method.

10 In the following it shall be noted that when the term automatic dishwasher is used there is meant dishwashers of the kind used in institutions for washing surgical equipment, laboratory equipment, clinical equipment, bedpans etc., where the hygienic requirements are high due to the danger of infection.

15 For hygienic considerations there is generally basic requirements for the arrangement of such washing machines such as an independent warm water tank. In order to prevent bacterial contamination the warm water tank may only be connected to a pure water supply (warm and/or cold) via an air gap, since bacteria cannot pass through this. Furthermore, the washing tank of these washing machines is disinfected with steam and thereby also the objects staying in the machine after the end of the washing process. The steam is supplied either from an external steam source or from an independently built-in steam source in the dishwasher. Such automatic dishwashers are also provided with a flushing pump for providing the necessary flushing pressure for the washing process, since the pressure from the pure water supply cannot be utilized because of the previously mentioned air gap.

20 An example of a such dishwasher is indicated in EP 0 093 846 B1, where the dishwasher comprises a warm water tank, the supply pipe of which has an air gap and a partly open surface. The warm water tank does not have an internal heating

coil but is supplied with warm and cold water from external sources. After the termination of the washing process the dishwasher performs a disinfection of the washing tank by means of steam which is either produced in an independent steam generating unit somewhere else in the machine or is supplied through pipe connections from an external source of steam. An automatic dishwasher with internal warm water tank and an independent steam generating unit is known from EP 0 055 926 B1. The indicated dishwashers do not perform disinfection of the warm water tank and the pipe connections between this and the washing tank, which makes these washing machines unsuitable for performing a subsequent chilling flush necessary for the objects in the washing machine to be handled manually immediately after the end of the washing process. The reason for this is explained in detail below.

It has appeared that formation of bacteria often occurs inside the warm water tank and in the pipe system between this and the washing tank of the washing machine, since the temperature range within which the warm water tank operates at the washing process (40°C - 65°C) makes it possible for e.g. legionella bacteria to survive, since these are only killed at a higher temperature. It is true that the bacteria in the washing tank are killed at the steam disinfection, but at the performing of a subsequent chilling flush there may be supplied bacteriae from the warm water tank to the washing tank with the chilling flush water and thereby to the items washed in the machine when using the above mentioned dishwasher.

The solution to the bacteria problem in the warm water tank may consist in either omitting the chilling flush, which will lower the capacity of the machine, since the washed ob-

jects have to be cooled down by the air before they can be handled manually. Alternatively the working temperature of warm water tank and thereby of the washing process may be elevated in general, so that the temperature of the warm water tank exceeds the survival temperature of the abovementioned type of bacteria. Thus it will be without any risk to perform a chilling flush after termination of the steam disinfection, but a general elevation of the working temperature will result in a considerable increase in the energy consumption of the washing process, which renders this solution unwanted.

Another solution could be that after performing the washing process the warm water tank is disinfected by supplying steam from a special internal or external steam source before it is filled up again, whereafter the chilling flush is performed with clean water supplied to the washing tank via the warm water tank. This procedure will be able to solve the problem, but should the occasion arise the establishment of a special steam producing unit is required, combined with control system, valves etc. for the washing machine, which hereby is made more expensive.

In FR 1.565.407 there is disclosed a system for improving a dishwasher for hospital equipment, instruments etc, and comprising a warm water tank with internal heating element, where the warm water tank is connected directly to the pure water supply, so that the supply pressure is used as a flush water pressure. The heating element produces steam for disinfecting the washing tank and the warm water tank together with the pipe connections inbetween. However, a such device is outdated, viz. the previously mentioned hygienic requirements, and furthermore today there is required a greater

flush water pressure than possible with a normal pure water supply.

The invention indicate a method for performing steam disinfection in a simple way of the washing tank, warm water tank, and pipe connections between these of a dishwasher in a simple way after the termination of the washing process in the dishwasher, so that a chilling flush may be performed without any danger of bacterial infection of the washing tank. The method is based on the realization that the mainly empty tank space of the warm water tank after the ending of the washing process and in combination of a built-in heating element may be utilized for generating steam, which by a pipe with a mouth at the top of the tank is led to the washing tank for disfecting the latter, in that the suction pipe of the bilge pump define a minimum water level by which there is sufficient water left in the warm water tank for the steam production necessary for the disinfection process. Thus by the method according to the invention the warm water tank has two functions, namely a function as warm water tank with a heating function and a function as steam generator for the production of steam for disinfecting the warm water tank and the pipe connections between this and the washing tank before a chilling flush is performed.

An automatic dishwasher for use when performing the method of the kind indicated in the preamble of claim 1 is characterized by comprising a warm water tank with a not emptyable and permanently wet well in which there is provided a heating element for a full or partial heating of the water for the washing process, which heating element also has the function of generating steam from the water left in the well, which water is led to washing tank of the washing machine via

one or more pipes connected to the top of the warm water tank.

With the purpose of achieving disinfection also of the flush pipe connections between the warm water tank and the
5 washing tank the steam pipes are connected with the flush pipe of the washing machine through pipe connections with check valves.

The advantage of this design is that by the method according to the invention there is achieved disinfection of the
10 warm water tank and the pipe connections between this and the washing tank of the washing machine, and that chilling flushing is performed from a newly disinfected tank and pipe connections, whereby bacterial growth is hindered. The check valves prevent the supply of flush water to the steam pipe
15 system during the washing process. Furthermore, the warm water tank with the integrated steam generator will be much less costly to produce since there is only need for one tank comprising one heating element with attached electric installations as compared to two before.

20 In a specially preferred embodiment the flush pipe system is provided with a draining device for draining the pump housing and the flush pipe connections after finishing the washing, so that pipe connections as well as pump housing are open for the passage of steam. Hereby there is also achieved
25 the advantage that also the pump housing is disinfected in connection with the steam disinfection before a possible chilling flushing.

For ensuring a sufficient steam flow through the pump housing the steam pipe in the top of the warm water tank may
30 be provided with a controllable shut-off valve, so that the steam flow is guided through the pump housing and the flush pipes by closing the steam pipe.

The warm water tank with integrated steam generator according to the invention may further be utilized as an independent unit in connection with other disinfecting washing machines.

- 5 The invention is described in more detail below with reference to the drawing, where:

Fig. 1 shows a schematic drawing of a dishwasher with warm water tank and integrated steam generator according to the invention,

- 10 Fig. 2 shows the same as fig. 1, but where the flush water system is provided with a draining device, and

Fig. 3 is a perspective view of an embodiment of a dishwasher according to claim 1.

- Fig. 1 shows a dishwasher comprising a washing tank 2, a
15 warm water tank 4, and a flush water pump 6 with an intake connected with the tank through a pipe connection 8. The pump 6 is connected to flushing nozzles 12 in the washing tank 2 through flush pipe 10. The warm water tank 4 is supplied with pure water through a pipe 14, which by a not shown air gap is
20 connected to a supply 16 of warm and cold water. The pipe 14 has a branch 18 connected to the washing tank 2 for ventilating the latter.

- The peculiar feature of the warm water tank 4 is that it comprises a bottom well 20 in which the pipe 14 is led down
25 to a level close to its bottom. In the well 20 there is also provided a heating element 22 for heating up fresh water supplied to the tank to the preferred washing temperature, and for the generation of steam.

- The intake pipe 8 of the pump is connected in such a way
30 to the warm water tank 4 that it only can be emptied to the level at the line 24, which means that the volume of the tank down to the level at the line 24 is adjusted to the water vo-

lume used at the whole washing process in the dishwasher, since the flushing water is not recirculated in the washing process in this type of dishwashers.

5 A pipe 26 is connected to the top of the tank for conducting steam to the washing tank 2 for disinfecting the latter.

The function of the warm water tank is that the tank 4 is filled with fresh water from the supply 16 for warm and cold water through the pipe 14. The heating element 22 is activated, if necessary, whereby the water is heated to the desired
10 temperature. The heated water is supplied to the flushing nozzles 12 in the washing tank 2 of the dishwasher by the pump 6, the pipe 8, and the flush pipe connection 10, and the flush water is discharged directly to the drain 28 of the dishwasher. At the finish of the washing process the water
15 level in the tank 4 is lowered to the level 24, which is defined by the upper edge of the pipe 8. Steam disinfection of the washing tank 2 of the dishwasher hereby takes place by heating element 22 heating a minimum quantity of water, i.e. the portion of water left in the well 20, so that steam is
20 generated and spread in the tank space 30 and herefrom to the washing tank 2 of the dishwasher through the pipe connection 26 in the top of the warm water tank 4, whereby the latter and the washing tank 2 is disinfected with steam.

No water is supplied to the warm water tank during the
25 disinfecting process, since the upper edge of the intake to the feed pipe 8 for the flush water pump 6 defines a certain minimum water level 24 at which there is enough water left in the well 20 for the steam production required for the disinfection process. By the extending the pipe 14 to a level close to the bottom of the well 20 there is created a trap preventing steam to escape through the pipe 14. By the steam
30 disinfection process there is performed disinfection of the

the washing tank 2 as well as the warm water tank 4 by using the warm water tank according to the invention, whereby possible bacteria in it are killed. Fresh water is filled into the warm water tank after ending disinfection of the washing tank and the warm water tank. The water is heated partly by the residual heat in the tank walls and partly by means of the heating element 22. In certain cases there may be performed a chilling flush in the dishwasher, which now may be performed with completely germ-free water from the the disinfected warm water tank in accordance with the Swedish recommendation for hygiene, Spri no. 742 01.

As appearing from Fig. 1 the steam pipe 26 may be provided with a branch 32 furnished with a check valve 34, so that the greater part of the flush pipes 10 and the flush nozzles 12 are supplied with steam and are thereby also disinfected.

In a specially preferred embodiment shown in Fig. 2 the flush pipe 10 is provided at the lowest point with a drain pipe 36 connected to the drain 28 from the washing tank 2. The drain pipe 36 is provided with an electromagnetic valve 38 the activation of which results in opening the pipe connection 36, so that the pump 6 and pipe connections 8,10 are emptied into the drain 28. Hereby the pipe connections and the pump housing are open for the passage of steam from the tank space 30 of the warm water tank, which results in that by this embodiment of the washing machine according to the invention there is achieved a complete steam disinfection of both warm water tank 4, washing tank 2, draining pipe 8, flush water pump 6, flush pipe 10, and flushing nozzles 12 in the washing tank.

For ensuring a flow of steam through the pipe connections 8,10 and the flushing nozzles 12, there may be provided an electromagnetic valve 40 (Fig. 2) on the steam pipe connecti-

on 26, which temporarily closes the steam flow through the steam pipe 26, which by continuing steam generation in the tank 4 will force the steam flow through the flush water pump 6 and the pipe connections 8,10 together with the flushing 5 nozzles 12. The electromagnetic valve 40 is coupled to the remaining control system of the washing machine for controlling the washing and disinfecting process.

In a further, not shown embodiment, the warm water tank may be furnished with level sensors and a control system so 10 that during the steam generation there is supplied water to the well 20 through the pipe 14 in order to maintain the water level designated by the line 24.

By the dishwasher according to the invention it is implied that the dishwasher may comprise essential automatic 15 control system for controlling and regulating the washing process as well as the steam disinfection, and also that the dishwasher naturally comprise means for the dosing of additives required for the washing and disinfecting process.

PATENT CLAIMS:

1. A method for steam disinfection of a washing tank (2) in a washing machine of the kind used for washing surgical equipment, laboratory equipment, clinical equipment, bedpans and the like, and comprising an independent warm water tank (4) supplied with pure water via an air gap, a flush pump (6) with feed pipe (8), which flush pump (6) is connected through flush pipe (10) to flushing nozzles (12) in a washing tank (2), characterized in that the steam required for the disinfection is generated by a heating element (22) situated inside the warm water tank (4) subsequently to the draining of the tank to a suitable level (24) by the flush pump (6) through the pipe (8) at the end of the washing process, and which steam is supplied through the pipe connection (26) in top of the warm water tank (4) and the pipe connection (8) to the washing tank (2) as well as the flush pump (6), flush pipe and flushing nozzles (12) for disinfection.

2. A disinfecting dishwasher for utilization of the method according to claim 1, comprising a washing tank (2), a warm water tank (4) supplied with pure water via an air gap, a flush pump (6) connected through flush pipe (10) to flushing nozzles (12) in the washing tank (2), characterized in that the warm water tank (4) has a not emptyable and permanently wet well (20) in which there is situated a heating element (22) for heating water for the washing process and for steam generation, which steam is conducted by pipes (8,26) to the washing tank (9) of the washing machine, where at least one of the pipes (8,26) is connected to the top of the tank.

3. A disinfecting dishwasher according to claim 2, characterized in that it comprises a pipe (14) extending down into the well (20) for filling up with water.

4. A disinfecting dishwasher according to claim 2 or 3, characterized in that the steam pipes (26) are connected to the flush pipe (10) of the washing machine through a pipe connection (32) with a check valve (34).

5. A disinfecting dishwasher according to any of the claims 2 - 4, characterized in that the flush pipe system (10) is provided with a draining device (36,38) for emptying the pump (6) and the flush pipe system (10), whereby the pipe connections (10) and the pump are open for the passage of steam.

6. A disinfecting dishwasher according to any of the claims 2 - 5, characterized in that the steam pipe (26) is furnished with a controlable shut-off valve.

7. A warm water tank (4) with built-in steam generator for disinfecting the washing tanks (2) of washing machines, especially disinfecting dishwashers, characterized in that the warm water tank (4) has a not emptiable and permanently wet well (20) in which there is situated a heating element (22) for heating the water for the washing process and for steam generation, which steam is conducted by pipes (26) connected to the tank top to the washing tank (2) of the washing machine.

8. A warm water tank according to claim 7, characterized in that it comprises a pipe (14) extending down into the well (20) for filling up with water.

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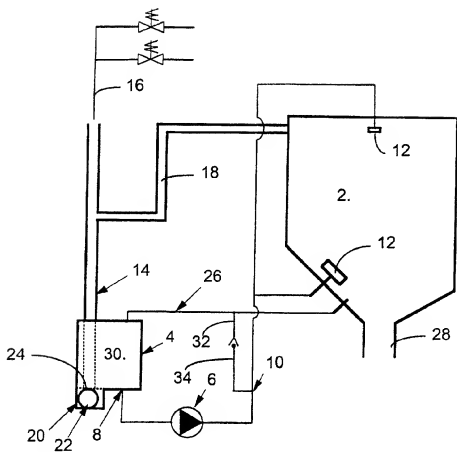


FIG.1

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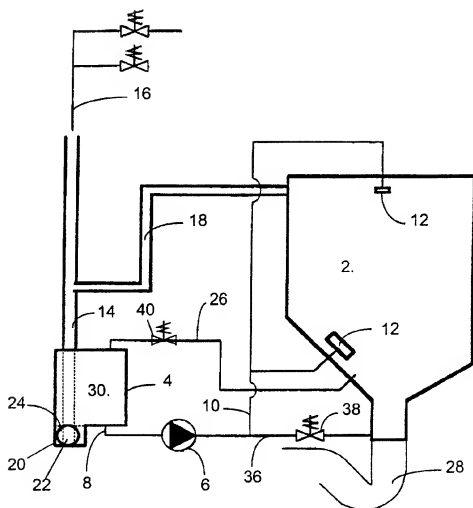


Fig.2

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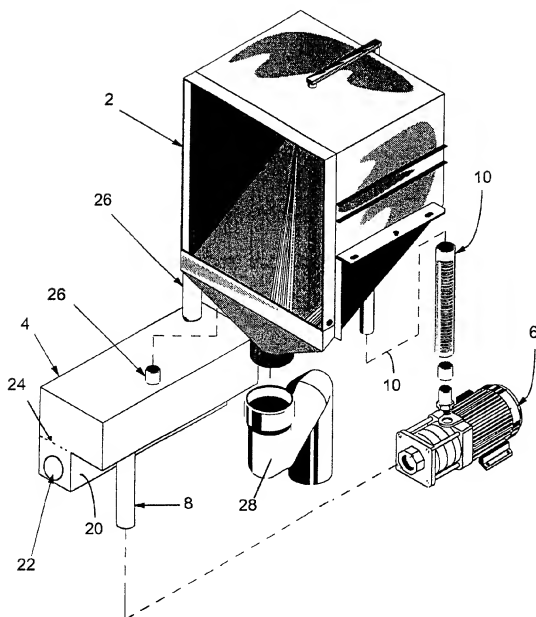


Fig.3

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK 96/00508

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A47L 15/00, A61G 9/02

According to International Patent Classification (IPC) or to both national classification and IPC

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IPC6: A47L, A61G

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 1565407 A (A. FERTE), 24 March 1969 (24.03.69), page 2, figure 1	7-8
A	--	1-6
Y	DE 4034380 A1 (KRETH, L.), 30 April 1992 (30.04.92), column 3, line 4 - line 57, figure 1	7-8
A	--	1-6
Y	US 4279384 A (K. YAMAMOTO), 21 July 1981 (21.07.81), figure 1, abstract	7-8
A	--	1-6

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0093846 A1 (SIC AG), 16 November 1983 (16.11.83), figures 1,5, abstract --	1-8
A	US 4235642 A (G.J. FEDERIGHI ET AL), 25 November 1980 (25.11.80), column 2, line 54 - column 3, line 25, figure 6 --	1-8
A	DE 2900957 A1 (MEIKO MASCHINEN- UND APPARATEBAU, INGENIEUR OSKAR MEIER GMBH & CO.), 31 July 1980 (31.07.80), figure 1 --	1-8
A	US 4135531 A (G.J. FEDERIGHI ET AL), 23 January 1979 (23.01.79), figure 1, abstract -- -----	1-8

INTERNATIONAL SEARCH REPORT
Information on patent family members

03/02/97

International application No.

PCT/DK 96/00508

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DE-A1- 4034380	30/04/92	NONE	
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EP-A1- 0093846	16/11/83	SE-T3- 0093846 DE-A- 3209305	22/09/83
US-A- 4235642	25/11/80	NONE	
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US-A- 4135531	23/01/79	NONE	